

CLAIMS

I/we claim:

1. An electrolyte membrane element for use in a fuel cell in which the membrane is sandwiched between a pair of electrode layers to form a membrane electrode assembly and the
5 membrane electrode assembly is held tightly between a pair of separators each having a gas flow channel facing the membrane electrode assembly, the electrolyte membrane element comprising an electrolyte membrane having peripheral portions tightly held by a frame having an elastic modulus of greater than about 2000 MPa and less than about 2,000,000 MPa and at least one elastic body having an elastic modulus of greater than 0 MPa and less than about 200 MPa, the frame and the
10 elastic body being configured to provide fluid-tight seals between the membrane peripheral portions and the respective separators.

2. A membrane electrode assembly for a fuel cell in which the assembly is held tightly between a pair of separators each having a gas flow channel facing the membrane electrode assembly, the assembly comprising an electrolyte membrane element according to claim 1, wherein
15 an area of the electrolyte membrane laterally surrounded by the frame is sandwiched between a pair of electrode layers, and wherein the at least one elastic body is not attached to the frame.

3. A membrane electrode assembly for a fuel cell in which the assembly is held tightly between a pair of separators each having a gas flow channel facing the membrane electrode assembly, the assembly comprising an electrolyte membrane element according to claim 1, wherein
20 an area of the electrolyte membrane laterally surrounded by the frame is sandwiched between a pair of electrode layers, and wherein the at least one elastic body is attached to the frame.

4. The membrane electrode assembly according to claim 3, wherein the frame and the at least one elastic body form a unit.

5. The membrane electrode assembly according to claim 4, wherein the frame and the at
25 least one elastic body are fusion bonded.

6. The membrane electrode assembly according to claim 4, wherein the at least one elastic body covers the entire surface of the frame.

7. The membrane electrode assembly according to claim 4, wherein the frame is (?) by the at least one elastic body.

8. The membrane electrode assembly according to claim 4, wherein the frame has at least one undercut portion and the at least one elastic body fills the undercut portion.

9. A fuel cell comprising an electrolyte membrane element according to claim 1 and a pair of electrode layers sandwiching an area of the electrolyte membrane laterally surrounded by the frame to form a membrane electrode assembly, and a pair of separators each having a gas flow channel facing the membrane, and tightly holding the membrane electrode assembly therebetween, such that the frame and the at least one elastic body provide fluid tight seals between the membrane and the respective separators.

10. The fuel cell according to claim 9, wherein each separator has at least one of the elastic bodies forming a unit therewith.

11. The fuel cell according to claim 9, wherein the frame and the at least one elastic body form a unit.

12. The fuel cell according to claim 11, wherein the frame and the at least one elastic body are fusion bonded.

15 13. The fuel cell according to claim 11, wherein at least one elastic body covers the entire surface of the frame.

14. The fuel cell according to claim 11, wherein where the frame is anchored by the at least one elastic body.

20 15. The fuel cell according to claim 11, wherein the frame has at least one undercut portion, and the at least one elastic body fills the undercut portion.

16. A fuel cell comprising an electrolyte membrane having peripheral portions tightly held by a frame having an elastic modulus of greater than about 200 MPa and less than about 2,000,000 MPa and a pair of electrode layers sandwiching an area of the electrolyte membrane laterally surrounded by the frame to form a membrane electrode assembly, and a pair of separators each having a gas flow channel facing the membrane and tightly holding the membrane electrode assembly therebetween, at least portions of the separators having an elastic modulus greater than 0 MPa and less than about 200 MPa, the frame and the separators being configured to provide fluid-tight seals between the membrane peripheral portions and the respective separators.

30 17. A fuel cell comprising an electrolyte membrane having peripheral portions, a pair of electrode layers sandwiching an area of the electrolyte membrane laterally surrounded by the

peripheral portions to form a membrane electrode assembly, a pair of separators for holding membrane electrode assembly tightly and each having a gas flow channel facing the membrane, and a seal configuration for forming fluid tight seals between the membrane peripheral portions and the respective separators, wherein the seal configuration comprises first and second frames having an
5 elastic modulus of greater than 2000 MPa and less than 2,000,000 MPa and the first and second frames lying on opposite sides of the electrolyte membrane in a region of the peripheral portions, and at least one elastic body arranged between the first and second frames and between the frames and the respective separators and contacting the peripheral portions.

10 18. The fuel cell according to claim 17, wherein the at least one elastic body covers entire surfaces of the first and second frames.